8. ORDNANCE AREAS

There are three large ordnance areas identified on the INEEL including the NPG, the Arco High Altitude Bombing Range, and the Twin Buttes Bombing Range (hereafter referred to as the Ordnance Areas). The locations of these areas are shown in Figure 13.

Activities during World War II also included practice aerial bombing at two bombing ranges established by the U.S. Army Air Corps. The Arco High Altitude Bombing Range was located adjacent to the southwest end of the NPG (see Figure 13); the Twin Buttes Bombing Range was located east of the southern end of the NPG, near the present-day Argonne National Laboratory-West (ANL-W) complex.

Most ordnance, UXO, and ordnance-related areas at the INEEL resulted from activities conducted at the Naval Proving Ground in the 1940s. The term *ordnance* refers to military equipment or apparatus. *Explosive ordnance* is any munition, weapon delivery system, or ordnance item that contains explosives, propellants, or chemical agents. UXO refers to these same items after being (1) armed or otherwise prepared for action; (2) launched, placed, fired, or released in a way that they cause hazards; or (3) unexploded either through malfunction or design (DOE-ID 1998). Areas containing ordnance must be remediated to mitigate risk to human health from unexploded ordnance and, as discussed in Section 9, explosive residues or explosive contaminated soil. Unexploded ordnance poses a physical risk to human safety through the danger of explosion when it is handled or contacted, especially by machinery.

Between 1942 and 1950, approximately 1,650 minor (3- to 5-in.) and major (16-in.) guns were tested at the NPG (see Figure 13). Most of the projectiles were nonexplosive. However, experimental and test work was also performed using live explosives, primarily in mass detonations. During these mass detonation tests, hundreds of thousands of pounds of explosives in land mines, smokeless powder, and bombs were placed in explosives storage bunkers or open areas and detonated to determine the effects to collocated bunkers and facilities. Stacks of ammunition were shot with high explosive projectiles to test their susceptibility to enemy fire. As a result of the NPG activities, many projectiles (explosive and inert), explosive materials, pieces of explosives, UXO, NPG structures, and debris remain. At locations where these materials remain from explosive testing activities, UXO is visibly obvious and some areas have undergone some limited remediation, such as at the Naval Ordnance Disposal Area (NODA). In other locations, where UXO remains from firing activities, projectiles have become imbedded in the ground (such as in large portions of the Naval Firing Range); therefore, UXO is not nearly as visibly obvious since debris from explosion does not exist.

In 1950, the 69,808.58 ha (172,494.65 acres) that composed the NPG were transferred from the Navy to the Atomic Energy Commission (AEC) for use as a nuclear reactor testing site. The AEC also acquired, through public land withdrawals, lands surrounding the NPG, including the two former bombing ranges.

In 1968, the Naval Ordnance Test Facility was established at the south end of the former NPG. The U.S. Navy used this facility after the NPG had been transferred to the AEC. The Naval Ordnance Test Facility was a temporary facility used to test 16-in. gun barrels, which fired inert projectiles at the Big Southern Butte.

Between about 1980 and 1985, the NODA Site, which had been used in the late 1940s as a disposal site, was used to treat hazardous waste by open burning under Resource Conservation and Recovery Act (RCRA) Hazardous Waste Management Act (HWMA) regulations. As discussed in Section 2.4.2.4, the Hazardous Waste Permitting Bureau (HWPB) of the IDEQ terminated the Interim Status for the NODA, EPA ID No. ID 4890008952, with the understanding that the CERCLA program would perform the final evaluation of the site in accordance with the FFA/CO and would include any requisite ARAR and HWMA reviews prior to issuance of the final Record of Decision.

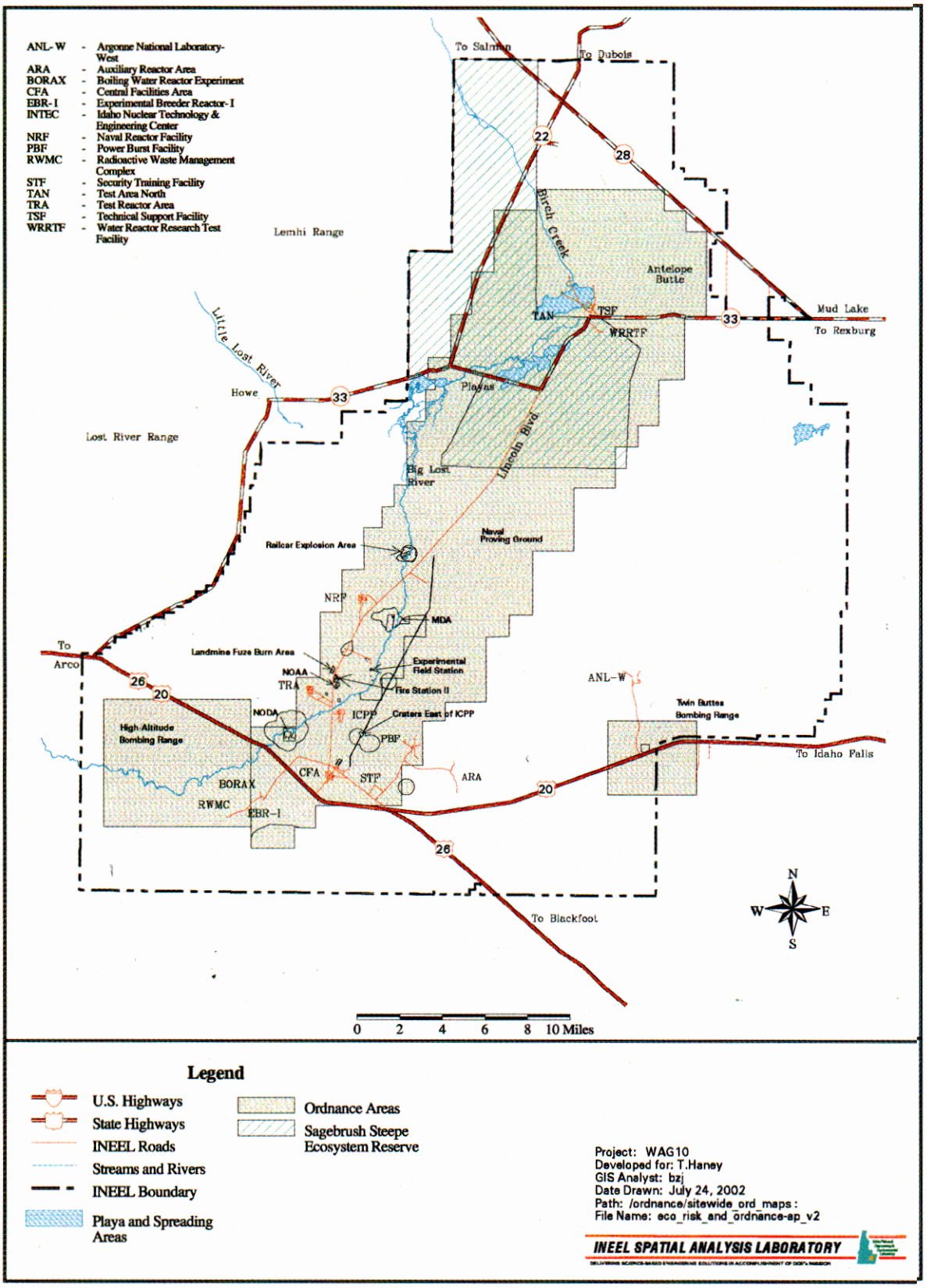

Figure 13. Locations of WAG 10 Ordnance Areas at the INEEL.

8.1 Investigations of the Ordnance Areas

UXO was cleared and field-assessed at several sites during each field season from 1993 through 1997. The term "clearance" when used in discussion of UXO is defined as "the removal of UXO from the surface or subsurface to a pre-established depth" (EPA 2001). However, the use of the term "clearance" or "cleared" in regards to UXO may not mean unrestricted land use. The ground surveys used to detect and "clear" UXO cannot be claimed to be 100% effective because of the multiple uncertainties in the detection methods. There remains risk for additional UXO to be located at six sites where it is known "live" ordnance was used even though past removal actions have been implemented. These sites include NODA , NOAA, MDA, Experimental Field Station, Rail Car Explosion Area, and the Land Mine Fuze Burn Area. Also, UXO buried below the surface soil may become exposed to the ground surface through erosion or frost heave, which would lead to an underestimation of risk.

The Preliminary Scoping Track 2 Summary Report for OU 10-03 Ordnance (DOE-ID 1998) summarizes the history of investigations and remedial actions performed prior to January 1997 for the 29 identified ordnance sites at the INEEL. The removal action that occurred in 1997 is documented in the *Summary Report for the 1997 Non-Time Critical Removal Action* (Sherwood 1999a). In 1999, soil samples were collected from several sites per the *Field Sampling Plan for Operable Unit 10-04 Explosive Compounds* (Sherwood 1999b). In 2000, a UXO walk-down was conducted at several sites to better define the extent of UXO fragments at NODA (Smith 2000). Figures 14 through 16 present photos of types of previously discovered UXO at the INEEL.

Twenty-nine individual ordnance sites were listed in Table 12-1 of the OU 10-04 Comprehensive RI/FS (DOE-ID 2001). Since the time of the development of this table, seven more sites have been identified on the INEEL as shown in Figure 2. Section 12 of the OU 10-04 Comprehensive RI/FS (DOE-ID 2001) summarizes information on each of these sites.

8.1.1 Naval Proving Ground (Naval Gun Range)

The NPG, also known as the Naval Gun Range, as shown in Figure 13, covered 69,808.58 ha (172,494.65 acres) and was used extensively for ordnance testing research. In 1942, the U.S. Navy had acquired the acreage to test fire 3- to 16-in. diameter Naval ship guns reconditioned at the Naval Ordnance Plant in Pocatello, Idaho. Between 1942 and 1950, approximately 1,650 minor (3- to 5-in.) and major (16-in.) guns were tested at the NPG.

When a projectile is fired from a big gun, a rotating band on the projectile, normally made of copper, engages the lands and grooves in the gun barrel. Although a small number of live and armed projectiles were fired from the big guns at close range into stacks of bombs, all the projectiles found to date with lands and groove gouges in the rotating bands have been target projectiles that do not contain main explosive charges. Unfortunately for cleanup, the rotating bands are not always visible and live bombs from the different tests described below exist in the same locations as the target projectiles. Additionally, there have been instances at the Jefferson Proving Ground where live projectiles have been inadvertently included in lots of inert munitions, which could increase the uncertainty of the extent of live projectiles that could be in the NPG.

Additional work at the NPG that resulted in 29 smaller ordnance sites located within the NPG area, included experimental and test work, primarily in mass detonations. During the mass detonation tests, hundreds of thousands of pounds of explosives in landmines, smokeless powder, and bombs were placed in explosives storage bunkers, railcars, or open sites and detonated to determine the effects on collocated bunkers and facilities. Numerous smaller detonation tests were similar in purpose, but much less explosive was used. These 29 sites were evaluated in the OU 10-04 Comprehensive RI/FS (DOE-ID 2001) and six were determined to have a high probability for and/or the confirmed presence of UXO.

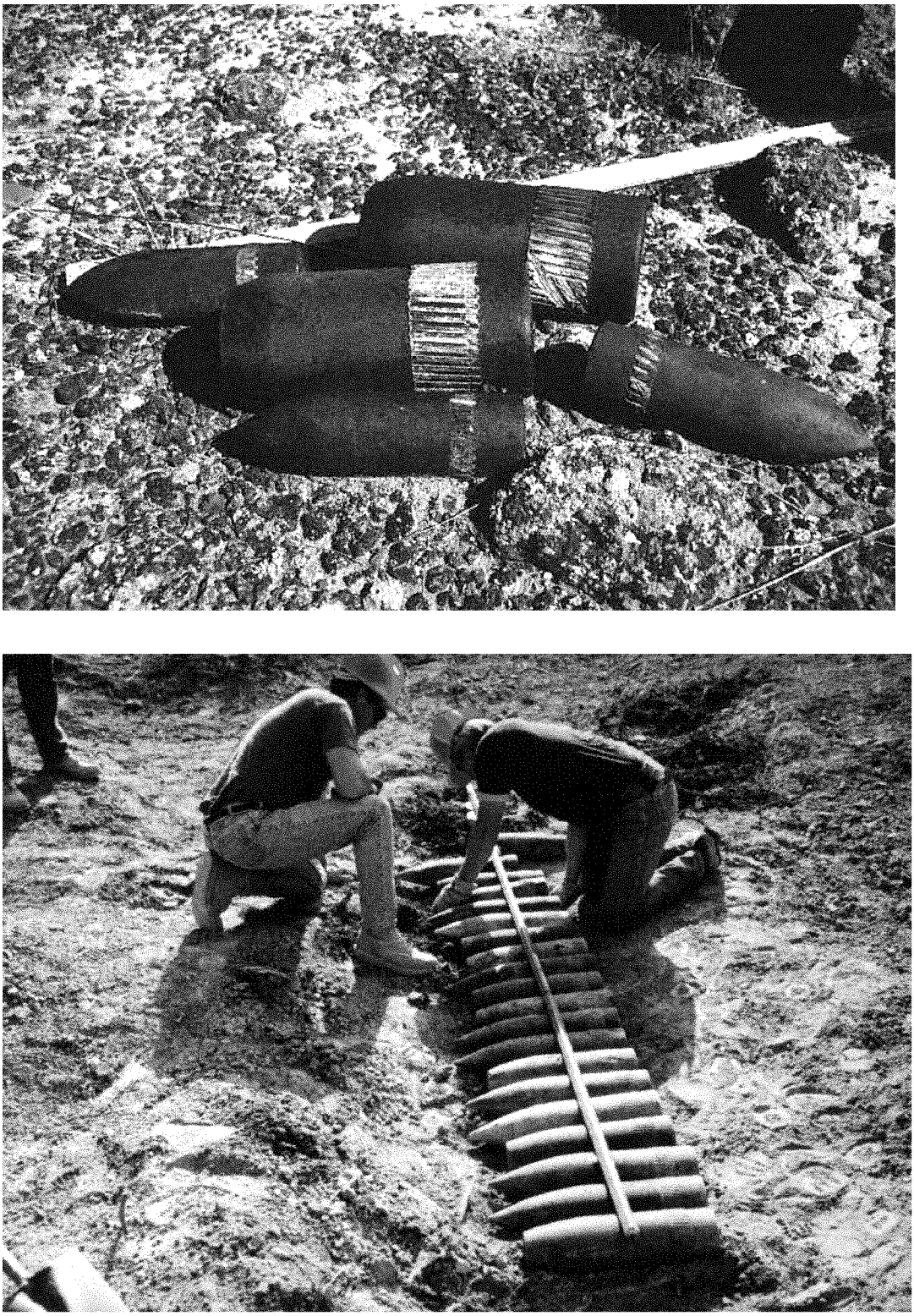

Figure 14. The top photograph shows a stack of five projectiles found along Power Line Road. They consist of two 5-in. and three 2-in. projectiles assumed to be non-explosive. Evidence of firing is shown near the end of the projectile by the rifling pattern in the rotating band. The bottom photograph shows a collection of projectiles being prepared for demolition using a flex-linear shaped charge at the MDA.

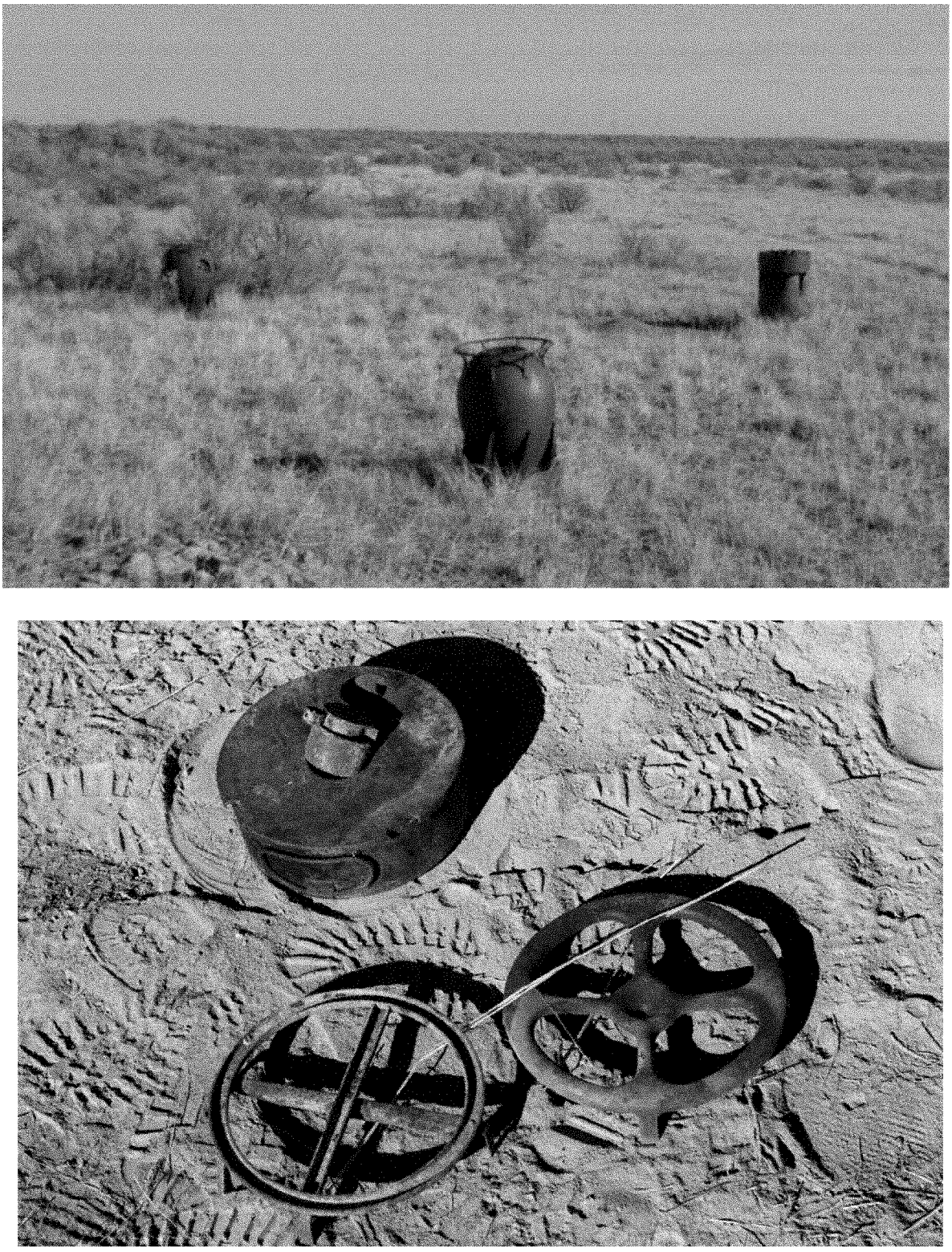

Figure 15. The top photograph is a picture of three depth charges located in the Rail Car Explosion Area. The bottom photograph is an example of a land mine fuze at the Land Mine Fuze Burn Area.

Figure 16. The top picture shows an aerial photograph of the MDA with its many craters. The bottom photograph shows a partially buried UXO located within the NPG.

These six sites include the Railcar Explosion Area, NODA,NOAA, the MDA, the Experimental Field Station, and the Land Mine Fuze Burn Area. Although UXO has been previously detected and cleared from these sites, clearance is not complete and the extent of potential UXO outside these areas has not been determined. The following paragraphs present a brief history of these ordnance sites.

8.1.1.1 Experimental Field Station. This site is located within the NPG gunnery range approximately 9.7 km (6 mi) downrange and northeast of the CFA-633 NPG firing site, and approximately 0.4 km (0.25 mi) west of the Big Lost River channel (see Figure 13). The site encompasses 556.5 ha (1,375 acres) and includes multiple craters where a variety of explosive tests were conducted. The site contains UXO, pieces of explosives, structural debris, and soil contamination (DOE-ID 1999c).

In 1996, the field team encountered remnants of World War I and World War II vintage bombs and two areas of widespread heavy concentrations of explosive-contaminated soils. One area was approximately 0.8 ha (2 acres) in size. The second area was approximately 0.3 ha (0.8 acres). The assessment included a visual examination for signs of craters, detonation tests, surface UXO, pieces of explosives, and soil staining. The area was searched for UXO using 10-m (33-ft) sweeps. When the team encountered areas of TNT contamination, the region was examined in great detail and mapped. Several large craters are located in this area. The craters appear to have resulted from ordnance destruction or ordnance testing and no ordnance has ever been found in these craters.

Approximately 2.4 km (1.5 mi) away, the nose section of a World War I vintage bomb containing TNT and an empty tail section of a World War I vintage bomb were found during the assessment and transported during the 1996 removal action to the MDA for disposal by detonation (DOE-ID 1998).

8.1.1.2 National Oceanic and Atmospheric Association (NOAA) . The NOAA site is located just east of Lincoln Boulevard, approximately midway between Mile Markers 4 and 5. It is thought the site was used for a variety of explosive tests or cleanup detonations, or both. The area contains a number of small craters, low-ordered bomb casings and detonators, and some widely scattered pieces of explosives. The NOAA site has been and is currently used by NOAA and other government agencies for a variety of atmospheric, geodetic, and weather-related monitoring and research work (DOE-ID 1997).

During the 1993 interim action, a surface clearance and a geophysical search were conducted to a depth of 0.61 m (2 ft) on a large 1.7 ha (4.13 acre) area and a small 0.88 ha (2.17 acre) area. No UXO was found below the surface.

During the 1996 field assessment, the major objectives of the field team was to determine whether ordnance or soil contamination existed outside the previously identified area, to establish the site boundary, to reestimate the volume of contaminated soil, and to look for any indications that detonation pits existed in the area. The field crews searched the area on foot at approximately 10-m (33-ft) intervals and located scattered TNT, ranging from small flakes to baseball-size chunks. The boundary was established and the large area of contamination mapped (see Figure 13). Several craters were located on the south side of the site that appear to be sites of ordnance destruction. Several partial 100-lb bombs were found southeast of the NOAA site, which indicates that the bombs had been intentionally low-ordered. A low-order detonation is the result of a low-order procedure, intended to detonate an explosive item without causing the item to totally consume itself. A low-order procedure is performed in an area that could not withstand a high-order detonation, which would have totally consumed the item (DOE-ID 1997).

8.1.1.3 Land Mine Fuze Burn Area. The site was used by NPG personnel for disposal of land mine pressure plates, aerial bomb packaging materials, and as an area to dispose of land mine fuzes by burning (DOE-ID 1998). The location of this site is approximately 0.8 km (0.5 mi) west of Lincoln Boulevard and 0.8 km (0.5 mi) north of the Fire Station II training area as shown in Figure 13. The site is estimated to encompass 19.7 ha (48.7 acres) (DOE-ID 1998).

During the 1996 field assessment, the perimeter was established, and the area for the removal action was defined (DOE-ID 1998). The subsurface was characterized using geophysics as part of a technology demonstration project in June of 1996. Approximately 0.6 ha (1.5 acres) were surveyed to a depth of 0.61 m (2 ft), and the area was mapped (DOE-ID 1998).

During the 1996 removal action, 8.1 ha (20 acres) were surface cleared, characterized using geophysics, and mapped. A subsurface clearance was not performed based on the removal action subcontractor's evaluation of the data. However, during the INEEL quality check of the results in the subsurface at this site, several inert items were found and excavated (DOE-ID 1998). Figure 14 presents photographs showing the types of UXO previously found within this area.

8.1.1.4 Mass Detonation Area (MDA). The MDA is located 1.6 km (1 mi) east of Mile Marker 8 on Lincoln Boulevard, north of the INTEC and approximately 3.2 km (2 mi) east of the NRF, as illustrated in Figure 13. The site encompasses 322 ha (796 acres) and has been used for a number of small- to large-scale sympathetic and mass detonation tests, with test shots ranging up to 226,800 kg (500,000 lb) of explosives. A sympathetic detonation test is a test to find out if a charge explodes when another charge is detonated next to it. The MDA site includes numerous blast craters varying in dimensions from a few feet to several tens of feet and is littered with large quantities of UXO, pieces of explosives, and structural debris scattered during past testing and recent ordnance detonation for disposal activities (DOE-ID 1998).

Prior to demolition operations during the 1993 interim action and the 1994, 1995, and 1996 removal actions, the demolition pit of the MDA was searched for UXO, and several were found. In addition, demolition area signs were placed every year, and the postholes were surveyed prior to placement of the sign posts (DOE-ID 1998). Figure 16 presents an aerial photo showing the MDA large detonation craters and storage bunker.

8.1.1.5 Rail Car Explosion Area. The site is approximately 3.2 km (2 mi) due west of Mile Marker 13 on Lincoln Boulevard and adjacent to the Big Lost River channel, approximately 4.8 km (3 mi) northeast of NRF, as shown in Figure 13. It encompasses 195 ha (483 acres) and contains the debris scattered from a sympathetic detonation test involving five railroad cars, each loaded with 13,608 kg (30,000 lb) of explosive ordnance for a total of 68,040 kg (150,000 lb). The crater is located near the west bank of the Big Lost River, and pieces of ordnance and explosives (mostly RDX) are located along both sides of the Big Lost River (DOE-ID 1998).

During the 1996 field assessment, the entire area was walked at 50-m (164-ft) intervals. The boundary of the mapped area was established at the last piece of fragmentation located.

During the 1996 removal action, an 8.1 ha (20 acre) test strip extending south from the detonation pit was cleared of surface ordnance and fragmentation (although UXO has been previously detected and cleared from this site, clearance cannot be considered complete). One live 12.7 cm (5 in.) projectile was found approximately 15 cm (6 in.) below the surface in the 8.1-ha (20-acre) area. About 1,928 kg (4,250 lb) of scrap metal and 11 kg (25 lb) of bulk explosive, mostly RDX, were removed. Two live, 12.7 cm (5 in.) projectiles were removed from the dry riverbed of the Big Lost River. All three projectiles and the bulk explosives were removed to the MDA and disposed of by detonation during the 1996 removal action. Three inert sea mines (depth charges) were located on the east side of the Big Lost River bed at the Rail Car Explosion Area (see Figure 15). The 8.1-ha (20-acre) strip was then mapped, and some of the anomalies (metal fragments) were excavated (DOE-ID 1998).

8.1.1.6 Naval Ordnance Disposal Area (NODA). The NODA site is located approximately 1.6 km (1 mi) northeast of U.S. Highway 20/26 between Mile Markers 266 and 267 and about 3.2 km (2 mi) equidistant from the TRA, INTEC, and CFA facilities at the INEEL, as shown in Figure 13. The NODA is estimated to encompass 55.8 ha (138 acres) (DOE-ID 1998). The U.S. Navy used NODA as an ordnance and nonradioactive hazardous material disposal area during the 1940s. Following the

establishment of the National Reactor Testing Station (now the INEEL), the NODA came under the control of the AEC (now DOE). From about 1967 to 1985, approximately 3,175 kg (7,000 lb) of reactive materials were treated (burned) at the NODA. Between 1967 and 1985, the NODA was also used as a storage area for hazardous waste generated at the INEEL. Until 1982, solvents, corrosives, ignitables, heavy metal contaminated solutions, formaldehyde, polychlorinated biphenyl materials, waste laboratory chemicals, and reactives were also stored at this site. By October 1985, all these materials had been removed for off-Site disposal as hazardous waste or treated on-Site by open burning, as allowed by RCRA regulations (DOE-ID 1998).

In 1985, NODA was added to the RCRA, Part A, permit application as a thermal treatment unit. The last treatment of hazardous waste occurred in 1988 (except for one emergency action/detonation in 1990). In June 1990, a Memorandum of Understanding (MOU) was developed between the Environmental Programs (EP) and Waste Reduction Operations Complex (WROC) under which EP agreed to fund and manage all activities necessary to formally close the NODA, including soil sampling and analysis, removal of contaminated soil, emergency removal of ordnance, maintenance of access signs and barricades, and preparation and submittal of all required documentation. In 1997, the Interim Status for the NODA was terminated by the IDEQ with the agreement that the CERCLA program shall perform the final evaluation of the site in accordance with the FFA/CO.

During the 1994 removal action, 11.7 ha (28.92 acres) were cleared of ordnance and pieces of explosives to a depth of 1.2 m (4 ft). An additional 1.6 ha (3.89 acres) were cleared to a depth of 1.2 m (4 ft) from Lincoln Boulevard to the NODA to accommodate an access road. Because of the lack of information pertaining to tests performed in the pits at the NODA site, none of the pits were addressed during the 1994 removal action. The removal action was continued during the summer of 1995, when an additional 9.1 ha (22.56 acres) were cleared to a depth of 0.61 m (2 ft). The depth was reduced to 0.61 m (2 ft) from 1.2 m (4 ft) based on the results of the 1994 removal action. At that time, five pits were remediated. Two pits were remediated with a remote excavator; two pits were remediated with a backhoe; and one pit was hand excavated. The pits were excavated until the geophysical surveys determined there were no additional anomalies (DOE-ID 1998). Although UXO has been previously detected and cleared from this area during the 2000 walk-down, additional 5 in. shells and other fragments were located (Smith 2000).

8.1.2 Arco High Altitude Bombing Range

The Arco High Altitude Bombing range was used during World War II by the Army for aerial bombing practice. As shown in Figure 13, this site is located approximately 9.7 km (6 mi) north and east, inside the southwest corner of the current INEEL boundary, and lies just southwest of Mile Marker 262 on U.S. Highway 20/26, which traverses the south end of the INEEL. The extent of the bombing range, shown in Figure 13, is taken from U.S. Army Air Corp documentation (DOE-ID 1998). This area is over 10,700 ha (26,400 acres) and is significantly larger than the area designated by U.S. Navy maps.

It is reported that the primary ordnance at this site had been M38A2 practice bombs. These practice bombs were 100 lb, sand-filled and air-dropped by B24 Liberator bombing aircraft flying out of the Army Air Corps base at Pocatello (DOE-ID 1998). M38A2 practice bombs included black powder spotting charges and simple, high-reliability, impact-activated initiators (DOE-ID 1998).

The entire site as defined by the Navy, as well as adjacent areas within the Air Corps delineation, was searched on foot by field crews in 1996 (DOE-ID 1998). The visual assessment observed no signs of craters, detonation tests, surface UXO, pieces of explosives, or soil contamination (DOE-ID 1998). The practice bombs, along with initiators, were characterized in detail during the 1996 field assessment.

8.1.3 Twin Butte Bombing Range

The Twin Butte bombing range was used by B-17 bombers, flying practice missions out of the Army Air Corps base at Pocatello beginning in 1942 and continued throughout World War II (DOE-ID 1998). As shown in Figure 13, this area is located near ANL-W on the southeastern boundary of the INEEL and is approximately 3,760 ha (9,291 acre) in area. The range straddles U.S. Highway 20, which was not in existence during the time that the range was in use.

The site was cleared to a maximum depth of 1.2 m (4 ft) in a 36 ha (90 acre) section during the 1994 removal action. Two detonation pits were encountered; however, no UXO, bulk explosives, or contaminated soil was observed in this area (DOE-ID 1998). Items recovered during the removal action included 1,409 expended practice bombs, one sand-filled practice bomb with the black powder spotting charge still installed, two live fuzes, and some partial bomb pieces (see ordnance inventory Appendix K [DOE-ID 1998]). Although UXO has been previously detected and cleared from this area, clearance cannot be considered complete for unrestricted land use.

During the 1996 field assessment, several empty and crushed practice bombs and an arming vane from a M100 bomb fuze were found (DOE-ID 1998). Several expended flare cases and one unexploded M26 flare bomb were also found. Two craters containing bomb fragments were located and investigated. These craters were the result of a high-order detonation and it cannot be determined whether the bombs were deliberately or inadvertently dropped from the air or brought to the location for disposal by detonation (DOE-ID 1998).

8.2 Nature and Extent of Contamination

A detailed summary of the previous investigations and remediation activities at the 29 ordnance sites, which are within the three ordnance areas (discussed by DOE-ID [1998] and shown in Figure 2) is presented in the OU 10-04 Comprehensive RI/FS (DOE-ID 2001). No evidence of UXO or soil contamination had been identified in previous investigations for 14 of the 29 sites. However, in some cases, these investigations were limited to only surface searches. Subsurface investigations using geophysical techniques were conducted at some sites, but these were typically limited in aerial extent and to depths of 0.6 m (2 ft) or 1.2 m (4 ft). Therefore, the possibility of subsurface UXO still existing in some areas cannot be eliminated.

Five of the sites within the NPG have confirmed UXO, as follows:

- Naval Ordnance Disposal Area (NODA)—This area was a demolition area for a large variety of ordnance items. An 8-in. projectile, Mk 25 Mod 1, was the largest ordnance item found during the two removal actions. The large number of items removed during two previous actions indicate the potential for fuzes, projectiles, and grenades continue to be present (DOE-ID 1998).

- Mass Detonation Area (MDA)—Heavy ordnance or explosive contamination at this site is not visually evident, despite the extensive explosive testing that occurred there. Historical documentation indicates a potential for land mines, bombs, bulk high explosive, and bulk smokeless powder to be present in this area (DOE-ID 1998).

- Experimental Field Station—This area has UXO, pieces of explosives, and structural debris scattered across a wide area. During the site inspections, 500-lb bomb casings and foreign bomb casings were found. It is very likely that live ordnance items are present in this area (DOE-ID 1998).

- Rail Car Explosion Area—A mix of Amatol-loaded bombs and TNT-loaded Navy mines were used in the rail car detonation. The scattered white explosives (RDX) found at the site most likely originated from two small craters near the rail car crater. Large fragments of 5- and 8-in. projectiles

with the explosive still in them can be found in and near both of the small craters. Historical documents indicate potential for bombs and Navy mines to be present in this area (DOE-ID 1998).

- Land Mine Fuze Burn Area—The fuzes found to date are M1A1, M1A2, and M4 land mine fuzes, a number of which still had intact detonators. These fuzes require 500-lb pressure on the pressure plate to function the fuze, but they may be functioned by a weight of 10 lb dropped from a height of 24 in. (DOE-ID 1998). Although a removal action was performed here in 1996 and 1997, additional land mine fuzes are likely to be present.

In summary, multiple types of ordnance and explosives have been recovered from the ordnance areas, which are the Arco High-Altitude Bombing Range, the Twin Buttes Bombing Range, and the NPG. To date, approximately 2,360 live items (UXO) have been removed and detonated (DOE-ID 1998). Because subsurface investigations were not conducted for all ordnance areas, and/or were limited in aerial extent and depth, there is significant uncertainty regarding whether UXO hazards remain at some OU 10-04 areas.

UXO is likely to be present at, and beyond, the NODA, the MDA, the Experiment Field Station, the Railcar Explosion Area, and the Land Mine Fuze Burn Area; currently, more UXO items are found intermittently both at known and at previously unidentified sites. As shown in Figure 2, seven more new ordnance locations were detected during the 2000 walk-down.

8.3 Summary of Site Risks

8.3.1 Human Health Risk Assessment

All sites that potentially contain UXO present some degree of risk. For human contact with OXO, risk may be evaluated in terms of three main components or events: (1) UXO encounter, (2) UXO detonation, and (3) consequences of UXO detonation.

A UXO encounter considers the likelihood that a person will come across UXO and will influence the UXO through some level of force, energy, motion, or other means. A UXO detonation is the likelihood that a UXO will detonate once an encounter has occurred. Consequences of UXO detonation encompass a wide range of possible outcomes or results, including bodily injury or death, health risks associated with exposure to chemical agents, and environmental degradation caused by the actual explosion and dispersal of chemicals to air, soil, surface water, and groundwater. Though UXO encounters occur, casual human contact has never caused a detonation at the INEEL.

The interim guidance recently developed for assessing UXO risk under the U.S. Department of Defense (DoD) Range Rule (DoD 2000) was reviewed for applicability to INEEL UXO areas. This rule identified a process for evaluating responses to risks from military munitions, unexploded ordnance and associated materials on closed, transferred, and transferring (CTT) ranges previously or currently owned by, leased to, or used by the United States. The interim guidance was not used at the INEEL because a number of controversies arose that resulted in the proposed Range Rule being withdrawn on November 14, 2000. Previous investigations had also indicated that insufficient data existed on OU 10-04 UXO areas to perform a risk assessment using the DoD guidance. Therefore, no quantitative risk assessments were performed for confirmed UXO areas.

8.3.2 Ecological Risk Assessment

UXO does not typically pose a risk to ecological receptors. Encounters ecological receptors may have with UXO are typically brief and detonation does not occur from casual contact. It is unlikely that an animal could strike a UXO with enough force to cause a detonation. As with human contact, no known accidental detonations have been caused at the INEEL by contact with ecological receptors.

8.4 Remediation Objectives for the Ordnance Areas

Remedial Action Objectives (RAO) for the ordnance areas were developed in accordance with the *National Oil and Hazardous Substances Contingency Plan* (NCP) (40 CFR 300) and EPA guidance (EPA 1988) and through the consensus of DOE-ID, EPA, and IDEQ participants. The RAOs are based on the results of both the human health risk assessments (HHRAs) and ecological risk assessments (ERAs) and are specific to the COCs and exposure pathways developed for OU 10-04.

The RAOs specified for protecting human health are expressed both in terms of risk and exposure pathways, because protection can be achieved through reducing contaminant levels as well as through restricting or eliminating exposure pathways. UXO does not have a typical exposure pathway where the overall intent of the human health RAOs is to limit the cumulative carcinogenic human health risk to less than or equal to 1E-04, and noncarcinogenic exposure to less than or equal to an HQ of 1. Therefore, the UXO at the ordnance areas was excluded from quantitative analysis in the baseline risk assessment (BRA). However, the potential UXO at these areas presents an unacceptable risk of acute physical injury from fire or explosion resulting from accidental or unintentional detonation. Therefore, an RAO pertaining to the explosive safety aspect of ordnance to eliminate or reduce the potential for exposure to explosive ordnance was developed. The RAO developed for the ordnance areas to protect human health is as follows:

- Prevent any inadvertent contact with potential UXO by onsite workers and members of the public.

8.5 Description of Alternatives for the Ordnance Areas

Three remedial alternatives were developed to address the ordnance areas: no action, limited action, and detection with removal and disposal of detected ordnance as shown in Figure 13. The major combinations of technology process options associated with each alternative are presented in Table 9. Each of the three remedial alternatives is discussed below.

8.5.1 Alternative 1, No Action

Formulation of a no action alternative is required by the *National Oil and Hazardous Substances Pollution Contingency Plan* (NCP) (40 CFR 300.430[e][6]) and guidance for conducting feasibility studies under CERCLA (EPA 1988). The no action alternative serves as the baseline for evaluating other remedial action alternatives. The alternative includes environmental monitoring, but does not include any actions to reduce potential exposure pathways, such as fencing, deed restrictions, or administrative controls (EPA 1988).

8.5.2 Alternative 2, Limited Action and Institutional Controls

The limited action alternative represents the continuation of current management practices at WAG 10 ordnance areas including site access restrictions, inspection, and monitoring. Remedial actions under this alternative focus on restricting access (i.e., fencing, deed restrictions, administrative controls). The effectiveness of the limited action would be evaluated by DOE-ID, EPA, and IDEQ during subsequent 5-year reviews. Additional monitoring would be initiated if determined necessary.

Table 9. Detailed analysis summary for the Ordnance Areas.

Criteria	Alternative 1 No Action	Alternative 2 Limited Action	Alternative 3 Detection, Removal, and Institutional Controls
Overall protection of human health and the environment			
Human health protection	No reduction in risk	Reduces risk by restricting access	Reduces risk by removing detected UXO and restricting access
Environmental protection	Not applicable	Not applicable	Not applicable
Compliance with ARARs			
Action-specific			
Military Munitions Rule – 40 Code of Federal Regulation 266, Subpart M	Not applicable	Would meet ARAR	Would meet ARAR
Idaho Fugitive Dust Emissions – IDAPA 58.01.01.650-.651	Not applicable	Would meet ARAR	Would meet ARAR
Rules and Standards for Hazardous Waste in Idaho– IDAPA 58.01.05.010.006, .008, and .011	Not applicable	Would meet ARAR	Would meet ARAR
Hazardous Waste Determination – 40 Code of Federal Regulation 262.11	Not applicable	Would meet ARAR	Would meet ARAR
Rules and Standards for Hazardous Waste in Idaho – IDAPA 58.01.05.009	Not applicable	Would meet ARAR	Would meet ARAR
Location-specific			
Native American Graves Protection and Repatriation Act —25 USC 32	Would meet ARAR	Would meet ARAR through surveys and assessments and actions deemed necessary	Would meet ARAR through surveys and assessments and actions deemed necessary
National Historic Preservation Act—36 Code of Federal Regulation 800	Would meet ARAR	Would meet ARAR through surveys and assessments and actions deemed necessary	Would meet ARAR through surveys and assessments and actions deemed necessary

Table 9. (continued).

Criteria	Alternative 1 No Action	Alternative 2 Limited Action	Alternative 3 Detection, Removal, and Institutional Controls
TBCs			
Real Property Contaminated with Munitions, Explosives, or Chemical Agents – DoD Standard 6055.9, Chapter 12	Would not meet TBC	Would meet TBC	Would meet TBC
Long-term effectiveness and permanence			
Magnitude of residual risk	No change from existing risk	Risk is controlled only through access restriction	Risk is reduced through UXO detection and removal, and continued access restrictions
Adequacy and reliability of controls	No control and, therefore, no reliability	Assumed to be adequate for the period of institutional control	Assumed to be adequate for the period of institutional control
Reduction of toxicity, mobility, or volume through treatment			
Treatment process used	No treatment process will be performed	No treatment process will be performed	Detection and detonation
Amount destroyed or treated	There will be no waste destruction or treatment	There will be no waste destruction or treatment	Amount of remaining UXO is not known
Reduction of toxicity, mobility, or volume	There will be no reduction of toxicity, mobility, or volume	There will be no reduction of toxicity, mobility or volume	Amount of UXO to be recovered and destroyed is not known
Irreversible treatment			Not reversible, but detonation of UXO will permanently eliminate risk
Type and quantity of residuals remaining after treatment	No treatment will be performed	No treatment will be performed	Inert metal – quantity is not known at this time
Statutory preference for treatment	Does not meet preference for treatment	Does not meet preference for treatment	Meets preference
Short-term effectiveness			
Community protection	Increase of potential risks to the public	Reduces potential risks to the public	Reduces potential risks to the public
Worker protection	Increase of risks to workers	Workers protected by engineering and administrative controls	Workers protected by engineering and administrative controls
Environmental impacts	No change from existing conditions	No change from existing conditions	Limited to disturbances from excavation of UXO
Time until action is complete	No action will be taken	Approximately 12 months	Approximately 36 to 48 months

Table 9. (continued).

Criteria	Alternative 1 No Action	Alternative 2 Limited Action	Alternative 3 Detection, Removal, and Institutional Controls
Implementability			
Ability to construct and operate	No construction or operation	Easy, involves installation of fencing and signs	Moderately difficult; involves use of specialized detection technology over very large areas; removal and detonation of detected UXO can be hazardous
Ease of implementing additional action if necessary	May require repeat of feasibility study and record of decision process	Moderately difficult, would involve detection and removal of UXO using specialized technology; removal and detonation of UXO can be hazardous	Moderately difficult, would involve detection and removal of UXO using specialized technology; removal and detonation of UXO can be hazardous.
Ability to monitor effectiveness	Monitoring of conditions is readily implemented	Monitoring of conditions is readily implemented	Moderate since UXO detection methods are rarely 100% effective
Ability to obtain approvals and coordinate with regulatory agencies	No approvals required	No difficulties identified	No difficulties identified
Availability of services and capacity	None required	All necessary services are available on-Site	UXO detection capability is available commercially; UXO removal and detonation services are available on-Site as well as commercially
Availability of equipment, specialists, and materials	None required	Equipment, specialists and materials for implementing site access restrictions and deed restrictions are available on-Site	Equipment, specialists, and materials for UXO detection are available commercially; equipment, specialists and materials for UXO removal and detonation are available on-Site as well as commercially
Availability of technology	None required	None required	Available commercially
Cost (net present worth, 5% discount rate)			
Capitol Cost	$ 0.2 million	$ 0.7 million	$ 12.0 million
Operations and Maintenance Cost	$ 2.2 million	$ 4.2 million	$ 4.0 million
Total Cost	$ 2.4 million	$ 4.9 million	$ 16.0 million

8.5.3 Alternative 3, UXO Detection with Removal, and Institutional Controls

Implementation of this alternative would involve detection of, and disposal operations on UXO. Disposal will consist of detonation at the MDA or in-place, if it is determined transport of the UXO to the MDA is unsafe. Detonation of UXO will be performed in a manner that does not threaten human health or the environment, and meets the minimum distance to the property of others, as specified in RCRA Open Burning; Waste Explosives regulation. Actions under this alternative would include performing geophysical surveys to detect UXO in select areas where known ordnance testing occurred with live ordnance, including, but not limited to, the Rail Car Explosion Area, NODA, NOAA, Experimental Field Station, Land Mine Fuze Burn Area, and the Mass Detonation Area. Although some UXO has previously been detected and cleared from these areas, it is likely that some UXO remains. UXO may also be found adjacent to the areas previously cleared because of the limited actions taken and limitations associated with the detection technologies used. New detection technologies are evolving rapidly, which will be evaluated for the use at the INEEL as they are developed and demonstrated.

The boundaries of the firing fan and bombing ranges from World War II activities are based primarily on historic data from World War II era documents, which is supported by ground observations. Significant uncertainty exists with respect to the extent of these areas and surveys are required to define these boundaries and the ordnance density and depth within the boundaries. Survey technologies will be evaluated and demonstrated for effectiveness before utilized for extensive UXO detection over the bombing and firing ranges. Locations of probable ordnance detections found during the surveys will be logged. Locations will be confirmed and ordnance cleared, as necessary, to support current and reasonable expected future land use.

The need for additional surveys or removal actions would be assessed during the remedy review and the statutory 5-year reviews. INEEL-wide access restrictions, such as institutional controls, will be necessary as long as an unacceptable risk remains.

8.5.4 Comparison of Elements and Distinguishing Features of Each Alternative

The relative performance of each alternative is described in Table 9.

8.6 Comparative Analysis of Alternatives for the Ordnance Areas

The comparative analysis of the remedial action alternatives is a measurement of the relative performance of alternatives against each evaluation criterion. The comparison identifies the relative advantages and disadvantages associated with each alternative. The alternatives were evaluated using the nine evaluation criteria as specified by CERCLA (40 CFR 300.43[f][5][i]). The purpose of this comparison is to identify the relative advantages and disadvantages associated with each alternative. The comparative analyses of alternatives for the nine criteria are summarized below.

8.6.1 Overall Protection of Human Health and the Environment

For the ordnance areas, Alternative 3 (UXO detection, removal, and institutional controls) would provide effective long-term protection of human health and the environment. UXO detected from survey efforts would be identified, removed, and detonated. Long-term institutional controls would be maintained to restrict access or activities. Alternative 2 would be protective by limiting access and exposure to UXO.

8.6.2 Compliance with Applicable or Relevant and Appropriate Requirements (ARARs)

Comparison of compliance with ARARs is summarized in Table 9 for the ordnance areas. The ARARs for Alternative 1 (no action) would not be met for the ordnance areas. Alternatives 2 and 3 for the UXO areas would meet ARARs.

8.6.3 Long-Term Effectiveness and Permanence

Alternative 1 (no action) would provide the least long-term effectiveness and permanence for the ordnance areas.

For the ordnance areas, Alternative 3 (UXO detection, removal, and institutional controls) would provide the highest degree of long-term effectiveness and permanence. Visual and geophysical surveys would be performed to detect UXO. Detected UXO would be removed and detonated as appropriate. However, because undetected UXO could remain in place, institutional controls will be required and remedy reviews and statutory 5-year reviews would continue during the institutional control period. Alternative 2 (institutional controls) would be somewhat less effective and permanent because direct exposure to UXO would still be a risk at the sites and risk reduction would rely primarily on access restrictions.

8.6.4 Reduction of Toxicity, Mobility, or Volume through Treatment

For the ordnance areas, Alternative 3 offers treatment of UXO by detonation in place or at the MDA. This alternative would reduce mobility concerns and reduce the potential volume of UXO present at the INEEL. Alternatives 1 and 2 do not provide any reduction in toxicity, mobility, or volume through treatment.

8.6.5 Short-Term Effectiveness

For the ordnance areas, the no action alternative is rated lowest in short-term effectiveness; without access restrictions and administrative controls on-Site workers could encounter UXO and suffer physical injury from inadvertent detonation. Worker risk is always a consideration of UXO clearance (Alternative 3) and is based on the amount and type of intrusive work involved and the potential for an explosion to occur. Though many precautions are taken to protect site workers, the density and type of UXO at the INEEL has not been completely determined and thus, Alternative 3 has higher short-term risk. Alternative 2 is considered the most effective in the short-term because administrative controls will limit human exposure to UXO and workers would not be exposed to the hazards associated with removal and detonation of UXO.

8.6.6 Implementability

Alternatives 1, 2, and 3 are all implementable. Alternative 1 (no action) would be the most implementable for the ordnance areas, since no change in existing conditions would be required.

The implementability of Alternative 2 is also high, many of the access restrictions are currently in place, and other administrative controls are easy to implement and maintain. Alternative 3 is more difficult to implement because specialized UXO detection capability is required to survey the vast land areas included in the ordnance areas, and methods currently available may not be completely effective at detecting all UXO under conditions at the INEEL.

8.6.7 Cost

Alternative 3 (UXO detection, removal, and institutional controls) is the most costly, at $16 million, because extensive effort is required to detect and remove UXO over such large land areas. The cost estimate is based on the use and operation of a helicopter mounted array of magnetometers to detect potential UXO and standard military practices to detonate UXO and recover metal fragments. The cost for Alternative 2 (limited action), which only includes efforts to implement and maintain institutional controls, is $4.9 million, and the cost for Alternative 1 (no action) is $2.4 million. Detailed cost estimates are included in the OU 10-04 Comprehensive RI/FS (DOE-ID 2001, Appendix I).

8.6.8 State Acceptance

The IDEQ has been involved in the development and review of the OU 10-04 RI/FS report (DOE-ID 2001), the Proposed Plan (DOE-ID 2002), and this ROD. All comments received from IDEQ on these documents have been resolved and the documents revised accordingly. In addition, IDEQ has participated in public meetings where public comments and concerns have been received and responses offered. The IDEQ concurs with the selected remedial alternative for the ordnance areas contained in this ROD and is a signatory to the ROD with DOE and EPA.

8.6.9 Community Acceptance

Community participation in the remedy selection process and Proposed Plan reviews included participation in the public meetings held February 7 and 12, 2002 (see Section 3). The 30-day public comment period was extended an additional 30-days from January 28, 2002, through March 29, 2002. The Responsiveness Summary, presented as Part 3 of this ROD, includes verbal and written comments received from the public and the DOE responses to these comments. Representatives of the EPA and IDEQ assisted in the development of the responses.

All comments received on the Proposed Plan were considered during the development of this ROD. Public concerns generally centered on the cost to perform geophysical surveys over all ordnance areas. Consequently, a phased approach to UXO detection and removal will be developed during the remedial design phase to reduce costs.

8.7 Selected Remedy for the Ordnance Areas

Activities at the ordnance areas that may have left UXO behind include aerial bombing practice, naval artillery testing, detonation research, explosives storage bunker testing, and ordnance disposal. Any UXO remaining in these areas can pose a physical risk to human safety if an explosion is triggered from handling or contact, especially by machinery. Alternative 3, UXO detection, removal, and institutional controls, was the selected remedy for the three ordnance sites to mitigate potential human health risk from inadvertent contact to UXO.

The remediation of the ordnance areas will include the following activities:

- Implement institutional controls consistent with land-use. The specific goals of the institutional controls are to control human activity at sites with suspected UXO contamination and prevent harm from unintentional detonation of UXO. Institutional controls can include access restrictions, excavation restrictions, and restrictive covenants, and other restrictions such as signage and educational programs. Institutional controls will be maintained until the UXO hazard is removed or reduced to levels acceptable for current and anticipated future land use.
- Perform visual and geophysical surveys for the presence of UXO. If aerial UXO detection methods are to be used, a demonstration shall be performed first over a specially designed test area and over a known high-impact area of ordnance testing to confirm effectiveness under INEEL site-specific conditions.
- Investigate potential UXO targets during the survey.
- Identify and define the boundaries of the firing and bombing impact areas and the weapons testing and ammunition detonation areas.
- Determine the ordnance density, explosive characteristics of the UXO, and ordnance accessibility.
- Determine the relative risks of land use based on the type, amount, and accessibility of UXO and determine the extent of UXO removal required to meet desired land use objectives.

- Perform surface clearance, surface geophysical investigations, and intrusive UXO removal with disposal by detonation at the MDA or in-place detonation. Address waste generated during detonation activities using current disposal practices.
- Dispose of other recovered non-ordnance items, such as shrapnel, at an approved landfill on the INEEL or sent off of the INEEL for recycling. If secondary explosive contamination, such as TNT or RDX is discovered, perform remediation as described for the TNT/RDX contaminated soil sites.
- Backfill excavated areas deeper than 1 ft, contour to match the surrounding terrain, and vegetate.

Geophysical surveys will be conducted over the ordnance areas shown on Figure 13 to identify potential UXO. Anomalies detected from the surveys would be noted and further investigated to determine whether intrusive investigation is necessary to remove suspect items. Any items removed that could be UXO will be detonated at the MDA, unless it was determined to be too hazardous to transport, in which case the UXO would be detonated at the location it was detected. Detonation of UXO will be performed in a manner that does not threaten human health or the environment, and meets the minimum distance to property of others as specified in the RCRA Open Burning: Waste Explosives regulation. Sampling will be performed to determine if products of incomplete combustion are present after detonation events at the MDA (or other areas where UXO is detonated). Although detectable levels are not expected, remediation of soil contamination of the MDA will be performed at post-remediation if residual risk exceeds 1E-04. Therefore, the MDA will be investigated for remediation after remediation of the UXO sites and the TNT/RDX sites is complete. Other non-UXO items recovered, such as shrapnel, would be disposed at an appropriate landfill at the INEEL, such as the CFA landfill, or sent off the INEEL for recycling, if permitted by DOE policy.

Geophysical investigations for buried munitions are seldom 100% effective. In many cases, a munition is buried too deep, is too small to be detected, or is constructed of a material difficult to detect. Later, through frost heave, erosion, or construction, the item can reach the surface. Also, because the total amount of munitions buried at a site is almost never known, complete recovery cannot be documented. Therefore, periodic surveys may be required and institutional controls established and maintained. For purposes of cost estimation, it was assumed that a helicopter boom-mounted magnetic detection system would be used to perform a survey over the NPG, the Arco High-Altitude Bombing Range, and the Twin Buttes Bombing Range, which also encompasses the weapons testing and ammunition detonation areas, and that hand-held detectors would be used in confirming the location of UXO identified from the aerial survey. The purpose of the survey is to define the boundaries of the bombing and firing ranges and the weapons testing and ammunition detonation areas and determine ordnance location and density within these boundaries.

Institutional controls will be maintained at the ordnance areas until the UXO hazard is removed or reduced to acceptable levels. Controls are required to restrain human activity at areas with suspected UXO contamination and prevent harm from unintentional detonation of UXO. In April 1999, the EPA Region 10 developed a policy for institutional controls. During the OU 10-04 remedial design/remedial action (RD/RA) phase for the ordnance areas, an operation and maintenance (O&M) plan will be developed that will contain the institutional controls for the ordnance areas that will follow the guidelines in the policy. This plan will establish uniform requirements of the institutional control remedy components for all INEEL ordnance areas and specify the monitoring and maintenance requirements.

Access to the INEEL is currently restricted for purposes of security and public safety. Site-wide access restrictions would limit accessibility until at least 2095 based on the Comprehensive Facility and Land Use Plan for ordnance areas within the INEEL boundary. Installation of additional fences or relocation of the existing fences may also be necessary. Other access control measures may include warning signs, assessing trespassing fines, and establishing training requirements for persons allowed access. Land-use restrictions will be specified if government control of the INEEL is not maintained throughout the institutional control period.

8.7.1 Cost

The estimated cost for Alternative 3, UXO detection, removal, and institutional controls, is $16 million. Cost estimates are based on the use and operation of a helicopter-mounted array of magnetometers and hand-held detectors to detect potential UXO over all INEEL ordnance areas, which is approximately 84,252 ha. (208,192 acres), and standard military practices to detonate UXO and recover metal fragments. Cost allowances are included to account for waste characterization, packaging, and continuing institutional controls. The elements of the cost estimate are summarized in Table 10 and details of the cost estimate are provided in the OU 10-04 Comprehensive RI/FS report (DOE-ID 2001, Appendix I). By implementing the remedy in phases, and postponing geophysical surveys over all ordnance areas until more effective and less costly methods are developed and demonstrated, the cost for this alternative can be reduced.

Table 10. Cost estimate summary for OU 10-04 Ordnance Areas selected remedy.

Description	Cost (Net Present Value)	Totals
Capital Costs		**8,990,000**
Remedial Design	**468,000**	
Remedial design/remedial statement of work	76,000	
Remedial design work plan	10,000	
Environmental, safety and health plan	95,000	
Sampling and analysis plan	102,000	
Quality assurance project plan	23,000	
Site operation and maintenance plan	34,000	
Draft final design/report preparation	23,000	
Remedial action work plan	59,000	
Plans and specifications	23,000	
Miscellaneous environmental documents	23,000	
Remediation Support	**146,000**	
Quality assurance	22,000	
Project office operations	124,000	
Remediation/Technical Support Activities	**42,000**	
Engineering and technical support	42,000	
Remedial Action	**8,290,000**	
Mobilization & prep. work	12,000	
Site work	8,249,000	
Site restoration	0	
Demobilization	12,000	
Other	17,000	
Removal Action	**44,000**	
Summary report	44,000	
Operations Cost		**3,197,000**
Cleanup Tech. Admin. Activities Program Management	**1,471,000**	
Project and baseline management/report	1,471,000	
Post ROD Ops and Maintenance	**1,500,000**	
Caretaker maintenance	1,500,000	
Monitoring	**226,000**	
Field sampling plan	0	
Sampling	0	
5-year reviews	226,000	
General and Administrative (G&A)		**171,000**
Subtotal Costs		**12,358,000**
Plus 30% Contingency		**3,707,000**
TOTAL PROJECT COST IN NET PRESENT VALUE		**16,065,000**

NOTE: Net present value is the cumulative worth of all costs, as of the beginning of the first year of activities, accounting for inflation of future costs. Net present values are estimated assuming variable annual inflation factors for the first 10 years, in accordance with DOE Order 430.1, followed by a constant 5% annual inflation rate. A constant 5% discount rate is assumed.

8.7.2 Estimated Outcomes of the Selected Remedy

For on-Site workers and members of the public, risk of potential contact with UXO will be reduced through detection and removal of UXO and restricting access and activities within the suspect UXO areas. However, geophysical investigations for buried munitions are seldom 100% effective and because the total amount of munitions buried at a site is almost never known, complete recovery cannot always be documented. Therefore, institutional controls will be implemented and maintained and periodic surveys may be required. The specific goals of the institutional controls will be to control human activity at sites with suspected UXO contamination and prevent harm from unintentional detonation of UXO.

Access to the INEEL is currently restricted for purposes of security and public safety. Site-wide access restrictions would limit accessibility until at least 2095 based on the Comprehensive Facility and Land Use Plan for ordnance areas within the INEEL boundary. Installation of additional fences or relocation of the existing fences may also be necessary. Other access control measures can include warning signs, assessing trespassing fines, and establishing training requirements for persons allowed access. Land-use restrictions will be specified if government control of the INEEL is not maintained throughout the institutional control period.

8.8 Statutory Determinations for the Ordnance Areas

8.8.1 Overall Protection of Human Health and the Environment

Alternative 3, the UXO detection, removal, and institutional controls, provides effective, long-term protection of human health and the environment. The removal of UXO from OU 10-04 ordnance areas will minimize potential long-term human health and environmental concerns associated with exposure to UXO. Detonation of ordnance will effectively destroy the material and reduce risk. Institutional controls will be maintained to limit access and future activity at the sites because there is the potential for buried, undetected UXO to reach the surface from frost heaves and erosion, thereby posing an unacceptable risk.

Short-term protection of human health is less effective, because workers would be exposed to safety hazards during UXO clearance. However, all potential risks during implementation could be controlled through administrative and engineering controls.

8.8.2 Compliance with ARARs and TBCs

The ARARs and TBCs for the selected remedy UXO survey, removal, and detonation, are presented in Table 11. Removal and detonation of UXO complies with the Military Munitions Rule and the Open Burning; Wastes Explosives provisions of RCRA. Since the MDA is in a remote location, miles from INEEL facilities and neighboring property, detonation of UXO at the MDA can be performed in a manner that will not threaten human health or the environment. Any waste generated from detonation of UXO will be subjected to a hazardous waste determination, and any waste determined to be RCRA regulated will be treated, if required, and disposed in an approved facility on or off the INEEL. The DoD Standard 6055.9, Chapter 12 "Real Property Contaminated with Ammunition, Explosives, or Chemical Agents," would be met by implementing and enforcing applicable provisions of the standard. All areas affected by WAGs 6 and 10 remedial activities would be evaluated for cultural resource concerns before disturbance. Activities in sensitive areas will be modified, as required, to meet ARARs. Therefore, the selected remedy will comply with ARARs and TBCs.

Table 11. ARARs and TBCs for the selected alternative—survey and removal—for OU 10-04 Ordnance Areas.

Category	Citation	Reason	Relevancy[a]
Action-specific ARARs			
Rules for the Control of Air Pollution in Idaho	Fugitive Dust IDAPA 58.01.01.650 and .651	Requires control of dust during excavation for recovery of UXO and other potential ordnance items.	A
Resource Conservation and Recovery Act – Standards Applicable to Generators of Hazardous Waste	Hazardous Waste Determination IDAPA 58.01.05.006 (40 CFR 262.11)	A RCRA hazardous waste determination is required for recovered UXO and other potential ordnance items, and any secondary waste generated during remediation, which is to be treated or disposed of on or off the INEEL.	A
Resource Conservation and Recovery Act – Standards Applicable to Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Units	General Facility Standards for Owners and Operators of Remediation Waste Management Sites IDAPA 58.01.05.008 (40 CFR 264.1[j][1-13])	General RCRA performance standards must be met during remediation.	A
	Equipment Decontamination IDAPA 58.01.05.008 (40 CFR 264.114)	All equipment used during remediation that contact hazardous waste must be decontaminated in accordance with RCRA requirements.	A
	Use and Management of Containers IDAPA 58.01.05.008 (40 CFR 264.171-177)	Hazardous waste generated during remediation that is managed in containers must meet RCRA requirements.	A
	Open Burning, Waste Explosives IDAPA 58.01.05.008 (40 CFR 265.382)	Detonation of UXO and other explosive ordnance items must be performed in a manner that does not threaten human health or the environment.	A
Resource Conservation and Recovery Act – Standards for the Management of Specific Hazardous Wastes and Specific Types of Hazardous Waste Management Facilities	Military Munitions Rule 40 CFR 266.205 and 206	Recovered UXO and other ordnance items that are identified as hazardous waste under RCRA must meet RCRA requirements for storage, if required during remediation on an interim basis, and transport. Any emergency response conducted during remediation involving munitions or explosives will be exempt from RCRA waste generator and transporter requirements.	A

Table 11. (continued).

Category	Citation	Reason	Relevancy[a]
Location Specific ARARs			
National Historic Preservation Act	Historic properties owned or controlled by Federal agencies 16 USC 470 h-2 Identifying Historic Properties 36 CFR 800.4 Assessing Effects 36 CFR 800.5	In accordance with federal requirements, the site must be surveyed for cultural and archeological resources before construction and appropriate actions must be taken to protect any sensitive resources.	A
Native American Graves Protection and Repatriation Act	Custody 25 USC 3002 (43 CFR 10.6) Repatriation 25 USC 3005 (43 CFR 10.10)	In accordance with federal requirements, the site must be surveyed for cultural and archeological resources before construction and appropriate actions must be taken to protect any sensitive resources.	A
TBC			
Real Property Contaminated with Munitions, Explosives, or Chemical Agents	DoD Standard 6-55.9, Chapter 12	Establishes requirements for disposition of real property known or suspected to be contaminated with ammunition, explosives, or chemical agents.	

a. A = Applicable; RA = Relevant and Appropriate

8.8.3 Cost Effectiveness

The selected remedy is considered cost-effective with respect to the level of protection of human health and the environment. The removal and treatment of UXO through destruction will provide for permanent effectiveness for current workers and future residents. Cost will be reduced through implementation of a phased approach to UXO remediation that will be developed during remedial design. When compared to other potential remedial actions, the selected remedy provides the best balance between cost and effectiveness in protecting human health and the environment.

8.8.4 Use of Permanent Solutions and Alternative Treatment Technologies

The selected remedy Alternative 3, the UXO survey, removal, detonation, and institutional controls, represent the maximum extent to which permanent solutions and treatment technologies can be used in a practical manner at the INEEL. Of those alternatives that are protective of human health and the environment and comply with ARARs/TBCs, DOE, EPA, and IDEQ have determined that the selected remedy provides the best balance of tradeoffs in terms of the nine CERCLA criteria.

8.8.5 Preference for Treatment as a Principal Element

The selected remedy uses permanent solutions through removal and disposal of UXO, a principal threat waste, through treatment by detonation. This satisfies the statutory preference for treatment as a principal element of the remedy.

8.8.6 Five-Year Reviews

The effectiveness of the institutional controls and the need for surveys or removal actions will be evaluated as part of the 5-year review process to assure that final remedial actions for UXO on the INEEL remain protective.